"Not waving, but drowning": Information Science in the 'Information Society'

"No saluda, sino que se ahoga": la Ciencia de la Información en la 'Sociedad de la Información'

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Resumen

Las contribuciones de los científicos de la información frente a la explosión de las comunicaciones electrónicas siguen siendo intensas y valiosas, pero todavía queda mucho por hacer, especialmente en lo que se refiere al usuario individual de la información, que no sólo se siente abrumado por la enorme cantidad de información, sino que cada vez sufre mas la exposición a información errónea e incluso a la desinformación. Por otro lado, aunque las ventajas de la tecnología de la información son evidentes, se ha evidenciado el peligro de que las personas sean cada vez más propensas a su uso excesivo, e incluso a un mal uso que origine y acreciente diversos problemas humanos. Se propone que los científicos de la información tomen un papel más activo en la lucha contra algunos de los problemas causados por la sobrecarga de información.

Palabras clave: Ciencia de la información. Prospectiva. Sobrecarga informativa. Desinformación.

Abstract

While the contributions made by information scientists to tackling the explosion of electronic communications are both widespread and valuable much still needs to be done, particularly as the individual user of information is not only overwhelmed by the sheer quantity of information, but is increasingly subject to the posting of misinformation and even disinformation. At the same time, while the advantages of information technology are apparent there may be a danger that people will become increasingly prone to overuse, and even misuse it leading to a number of human problems. It is proposed that information scientists could take a more proactive role in tackling some of the problems caused by information overload.

Keywords: Information Science. Future of Information Science. Information overload. Disinformation.

1. Introduction

The quotation in the title is taken from a poem with that title by the poet Stevie Smith, expressing the ambiguity of a swimmer waving to people on the shore – waving in pleasure or signalling for help? Though the words in the poem are here used in a different context they convey well the feeling of a desire for help as one is overwhelmed by a tidal wave of information. This is not an academic paper and the author does not profess to understanding the age of electronic communications in which most of us now live. It is also biased towards experience in the UK though it is hoped that the issues may resonate with other nationalities. The paper poses two questions, the first being to ask what role might 'information science' play in the new paradigm; the second being to ask whether we are in danger of becoming slaves to the new technologies and in the process losing some of our human faculties. The paper has a partial and tentative answer to the first question and leaves it to the reader to answer the second.

Increasingly this word 'Information' and its partner 'Knowledge' are becoming so common and widely used that we, in the traditional field of 'Information Science', must be clear as to the multiple uses and meanings that many others have bestowed on the two words and in their combinations. I have argued before, for instance at a previous Ibersid Conference (Gilchrist, 2013), that the phrase 'Information society' is a misnomer for what would be better termed the 'Communications society'. The rise of the Internet supporting access to the World Wide Web, coupled with the phenomenal interconnections afforded by social media in general and particularly services such as Facebook and Twitter have created a communications explosion in which potential information can be overlooked in the competition of other 'messages' vying for attention. The word 'potential' is used here to indicate both that the message containing the information may or may not be noticed, but also that the transitory nature of the transmission may not offer sufficient time for the information to be digested or reflected upon and added to the personal store of understanding that we call knowledge. There is no doubt concerning the many beneficial aspects of information technol-

ogy, but it is vital that mankind becomes its master and not its slave.

The term 'Knowledge economy' is more acceptable but needs to be seen in a historical context. The concept has roots in the work of the sociologist Daniel Bell (1976), particularly in his book describing the 'post-industrial society' in which he claimed rightly that new science-based industries would lead to an increased valuation of knowledge which would, in turn, lead to a shift from manufacturing to services (just think of the size of the financial sector), but it overlooks the fact of the present reliance on goods manufactured and imported from the developing countries using cheaper labour. To a degree, it follows that the concept of a post-industrial society is relative, both geographically and historically, and this impinges on our understanding of the term 'Knowledge economy'. Certainly it cannot be said that all societies have been equally affected by advanced technology either in all countries or even within some of the countries of the richest economies. For example, following the industrialization of agriculture in developed countries, the percentage of workers on the land in the U.K., was about 1% of the total workforce in 2012 compared to 51% in Cambodia. At the same time many old crafts, based on tradition are dying out in the developed countries. Globally, there is still a tremendous difference between the developed and the developing world with the so-called knowledge economies living alongside what might be termed 'know-how economies', and this has some relevance to the problem of the role that information science could play in a globalized context. Stehr (1994) agrees with Bell saying that "Science and technology are remaking our basic social institutions" but goes on to say that "Our knowledge about knowledge remains unsophisticated and incomprehensible". Stehr offers a triplet typology of knowledge:

> Meaningful knowledge:
>
> The knowledge of most of the social science disciplines and the humanities is knowledge which in its primary social function affects mainly the (social) consciousness of members of society.
>
> Productive knowledge:
>
> Most of the traditional disciplines in the natural sciences generate productive knowledge in that such knowledge can be converted into ways of directly appropriating natural phenomena.
>
> Action knowledge:
>
> The most recent form of knowledge, as an immediate productive force, may be considered to be action knowledge because such knowledge is already a direct form of social action. It is the immediate capacity for action and this includes the capacity to generate more (new) knowledge.

The first two of these three elements are straightforward recognitions of the subject areas of knowledge and their ability to reflect on, and alter, man's position in the world but the third reflects the growth in the ability of society through individual and collective action to operate on itself, The agents of action are, of course, numerous and include traditionally government, business corporations, societies and institutions and charities, but now increasingly, pressure groups from lobbies attempting to influence government to well-organized movements such as Greenpeace and looser factions such as UK Uncut, and the Greek Syriza and the Spanish Podemos (the latter two now political parties) and, of course, many individuals acting independently. All of these actively seek to influence other organizations and individuals using formal and informal methods of electronic communication, creating the vast sea of long and short communications in which so many people are in danger of drowning.

2. Information science: theory or practice?

According to the authoritative Oxford English Dictionary, the first use of the term 'Information science' occurred in 1955, the author being Jason Farradane. Oddly, he had also been the first to use the term 'Information scientist' which might have been expected to precede the former term (1). It is clear that Farradane already had plans to establish the Institute of Information Scientists (IIS), followed by the first academic course in information science at the Northampton College of Advanced Technology in London (now City University). The original concept of an information scientist was that he or she would act as an intermediary between a scientist or team of scientists and the resources relevant to their work. Information scientists were required to have a degree in science or technology as well as a second language. The work entailed searching for relevant material, compiling structured and annotated bibliographies, keeping the recipients informed of current developments and acting as adviser and assessor of the reliability of sources. Initially, most of these people worked in industrial libraries but the areas of work expanded to include others such as universities, government and learned societies, eventually becoming even more widespread. The essence of this initial service was that it was physical, based on the handling initially of documents and later of computers, but also fundamentally social in that it involved a close relationship between

information scientist and scientist, as well as originators of information and those operating the channels of communication. Both the Institute and Aslib (Association of Special Libraries and Information Bureaux) worked together to promote good practice and provide education, meetings and conferences; conducting research and making presentations to government and industry. Both were at the forefront of developing new techniques, working with the maturing information technology industry on, for example, the design and application of information retrieval software. In its early days, Borko (1968) defined Information science as "...that discipline that investigates the properties and behavior of information, the forces governing the flow of information, and the means of processing information for optimum accessibility and usability." Thus, it is not only seen as a discipline rather than as a science, but still seems relevant in the current era of communications technology. Vickery and Vickery (2004), in their classic book Information Science in Theory and Practice suggested that

> Information science should seek to increase our understanding of:
>
> 1) The behaviour of people as generators, sources, recipients, and users of information and as channel agents;
>
> 2) The quantitative study of the population of messages – its size, growth rate, distribution, patterns of production and use;
>
> 3) The semantic organization of messages and of channels that facilitates their identification by sources and recipients;
>
> 4) Problems particularly associated with the functions of information storage, analysis and retrieval;
>
> 5) The overall organization of information systems and their performance in transfer;
>
> 6) The social context of information transfer, in particular its economics and politics.

While this echoes some of the language used by Borko thirty-six years earlier, it is even more appropriate to the situation of today, particularly in the use of the words 'messages' and 'the social context'.

However, after some years of acting as information intermediaries, the role of the information scientist was radically changed and, in some cases, dispensed with on the advent of distributed processing, providing what became known as 'knowledge workers' with their own terminals and later with powerful networked desk-top computers. In many cases the IT Department took over the provision of information through intranets and access to the World Wide Web, and many information departments were either downsized or even disbanded. The IIS collapsed and was merged with the Library Association, or rather submerged into an organization some ten times bigger (now called the Chartered Institute of Librarians and Information Professionals). Since then, the UK has seen a persistent fragmentation of societies and institutes concerned with aspects of information handling, these including various separate Special Interest Groups of CILIP though having overlapping aspects of information science, the Information Retrieval Specialist Group of the British Computer Society, ISKO UK and separate bodies representing records managers, archivists, indexers and professionals concerned with museums documentation. This fragmentation does not seem to have helped to advance the concept of a science of information, being confined to a range of related practices and there has been little cohesion between those disciplines that might be interested. It is also apparent that Information Science is increasingly becoming absorbed in the wider area of information technology as can be seen, for example, from the website of the Journal of Information Sciences (note the plural), published by Elsevier, a former publisher of the still extant Sage publication Journal of Information Science (note the singular). The blurb for the newer journal states that it is "interested in state-of-the-art research activities in information, knowledge engineering and intelligent systems. Readers are assumed to have a common interest in information science but with diverse backgrounds".

3. Snapshots 1: Information Science in practice today

Rather than attempting the huge task of reviewing the state of information practice in the world today, this section provides a few snapshots of activities that throw some light on the general situation from which it might be possible to discern a broad pattern.

3.1. CERN

The European Organization for Nuclear Research, known as CERN (Conseil Européen pour la Recherche Nucléaire) is the largest particle physics laboratory in the world. According to Wikipedia, the laboratory in 2013 "had 2,513 staff members and hosted some 12,313 fellows, associates, apprentices as well as visiting scientists and engineers representing 608 universities and research facilities and 113 nationalities." This enormous network is supported by the Scientific Information Service which has a staff of 37, including 9 librarians and 3 library apprentic-

es, 2 archivists and 22 in a section called Open Access. This section operates the SCOAP3 Open Access Repository advising authors on the process for entering their work in the database, as well as users on accessing material in this and other electronic databases held by the organization. This is a huge shared knowledge network appropriately run by the organization where the World Wide Web was first prototyped by its principle inventor, Tim Berners-Lee. Not surprisingly, this is a scientific community that has organized what seems to be a highly effective and efficient information service, and one which is possibly mirrored in other areas of research such as genomics and neuroscience.

3.2. KOS

There are several large international agencies that have evolved over the years from traditional electronic databases supported by traditional thesauri to more complex and sophisticated systems, of which four are profiled below:

3.2.1. National Library of Medicine

The American NLM operates the largest medical literature database in the world known as MEDLINE, the online version of MEDLARS (Medical Literature Analysis and Retrieval System), a continuation of the Index Medicus which was established in 1879. MEDLINE now contains over 22 million records from 5,639 selected publications, and a version is available to the public under the name PubMed. In addition, the NLM maintains bilateral agreements with public institutions in foreign countries to serve as biomedical information resource centres. MEDLINE is supported by MeSH (Medical Subject Headings) which was translated into thesaurus format when MEDLARS was born. MeSH, presented in both alphabetical and hierarchical displays now has 27,149 descriptors and over 218,000 lead-in terms augmented by over 219,000 headings called Supplementary Concept Records, held in a separate thesaurus. In addition NLM operates the UMLS (Unified Medical Language System) which integrates key terminology, classification and coding standards.

3.2.2. Food and Agriculture Organization

The UN agency FAO situated in Rome supports a vast international network of agricultural information centres, and provides a set of databases concerned with various aspects of agriculture, including fisheries and aquaculture. The main thesaurus AGROVOC is available in 21 languages as an SKOS-XL concept scheme and published as a Linked Open Data set aligned to 13 datasets.

The English version contains 40,881 preferred and non-preferred terms representing 32,000 concepts.

3.2.3. The European Union

The Union operates a documentation service that supports the work of the European Parliament and its Publications Office as well as being made available to national and regional parliaments in Europe. The central service uses a complex vocabulary called EUROVOC which is available in the 23 languages of the Union. This tool with its ontology-based thesaurus management conforms to the recommendations of the W3C, the body responsible for issuing standards for the World Wide Web. The highly structured scheme consisting of meshed fields and microthesauri contains some 6,833 descriptors.

3.2.4. Getty Research Institute

The Research Library of the Getty Research Institute focuses on the history of art, architecture and archaeology with relevant materials in the humanities and social sciences. The collection, which was principally devoted to the cultures of Europe and North America has expanded to embrace many other regional cultures and now contains over one million bibliographic items. The Library supports four structured vocabularies: the Art and Architecture Thesaurus, the Getty Thesaurus of Geographic Names, the Union List of Artist Names, and the Cultural Objects Name Authority. These are searched through the Art & Architecture Thesaurus which is updated monthly, contains about 20,000 terms and is partially available in six languages other than English, a work in progress.

3.3. Linked Data

An area in which there is much information science activity is the Semantic Web, and in particular that devoted to Linked Data. Bizer et al. (2009) give a useful account of Linked Data with details of the standards used in the Linked Data Technology Stack, including the important Uniform Resource Identifier (URI) which, in every application, identifies an entity. Clearly, there will be ambiguities between such entities in the various applications so that it becomes necessary to disambiguate the URIs (e.g. Berlin, the city and Berlin, the composer). The authors describe search engines, such as Falcons and SWSE that crawl linked data from the Web by following RDF links (Resource Description Framework, another standard that encodes data in the form

of a triple representing subject, predicate, object, each of these having its own URI).

3.4. Business enterprises

Contrary to the above success stories the situation in the business sector is not so cheerful as Foster (2014) reports in an account of a report from an industry analysis agency: "Gartner predicts in a recent study that by 2017, 33% of Fortune's 100 organizations will experience an information crisis due to their inability to effectively value, govern and trust their enterprise information". The report also found that unstructured information was particularly badly dealt with.

The snapshots above, while few and somewhat arbitrarily chosen are not surprising. Science is well established, comparatively well-funded and consciously reliant on broad and timely information. It is also well placed to take advantage of the new information technologies. The Getty Research Institute is also philanthropically well-funded. The enormous worldwide activity in improving the Semantic Web through linked data is also not surprising and is likely to continue with increased vigour. What is perhaps surprising and not a little worrying is the situation in the business enterprises. Though many of these organizations have spent enormous sums of money on the technology and on facilities such as data processing and storage, websites and intranets, customer relations systems etc., there seems to be little architectural co-ordination between different systems and a poor understanding of the value of good information provision. Frequent surveys over the years have shown that senior management continue to profess a strong belief in the value of information coupled with a bland confidence that their organization is providing effective support to its employees, but which is denied by the responses of their employees who complain about the poor information systems support.

4. Snapshots 2: the whirlpool

The current situation seems to have arrived and spread so quickly that while many are excited by it, there is also some confusion as many people strive to get used to the advantages and disadvantages and settle into a new modus vivendi. It is also evident that many organizational entities have been quick to seize on a new opportunity for 'getting their message across', thus adding to an information overload experienced by many both at work and in the home. Everybody connected to the Internet has access to enormous amounts of resources on the Web and to potentially hundreds, if not thousands of individuals, family, friends and complete strangers through social media. This huge flow of communications is bound to include much misinformation and even disinformation (information that is wilfully made inaccurate by the sender). The pressure on each individual to sort out the accurate and the credible from the inaccurate and the propaganda is acute, and any thought of checking the facts from other sources is either not considered or abandoned for lack of time. Recipients of bad 'information' have never been so exposed. This section continues the use of snapshots to outline some of the issues; to attempt more would be impossible in such a social complex.

4.1. Politics (and its relationship to the public and to industry)

There are many government websites, many of them excellent repositories of basic information. There are also some very complex sites, such as that operated by the tax authorities for the online submission of tax returns. However, all the political parties use other channels (such as the media which will be discussed below) to broadcast their views to the public and some of this is, inevitably, questionable, and can be found to be misinformation. There have also been cases where the issue of disinformation has been suspected. In all cases, the individual member of the public is left to compare different messages and to come to a personal conclusion:

- During the recent election campaign in the U.K. all the parties issued figures dealing with the economy either as part of their manifestos or as attacks on opposing parties. Many of these figures were deemed by independent and informed agencies to be inaccurate.
- It is a central discipline of science not to be dogmatic, so that their pronouncements concerning climate change are usually, if not always, preceded by such caveats as "There is substantial evidence that ..." And in this case this statement is followed by advice such as the recommendation that the sea level temperature should not be allowed to rise by more than two degrees. It has recently been disclosed that one of the largest oil companies has issued an internal document suggesting four degrees as their guiding limit. Who to believe? A recent U.K. survey showed that 81% of the sample believed that global climate is changing; 72% considered that climate will pose a serious threat to global stability within the next 50 years; and 45% that government should take more res-

> ponsibility for tackling global warming. So the individual waits for informed action from above, and becomes involved in local conflicts over the siting of wind farms or allowing drilling companies to conduct fracking explorations.

4.2. Journalism

It is, of course, the business of newspaper and magazine owners to sell their publications and their revenues are massively bolstered by carrying advertisements (which will be discussed below). To a large extent this practice is acceptable, though the sheer amount of space given to such material can be tedious. What is less acceptable is the way in which many of the newspapers (with particular reference here to practices in the U.K.) do not adopt an impartial informative style, but reflect the political views of their owners. It is worth noting here that 75% of the UK press is owned by five people, all billionaires, four of whom are domiciled outside the UK and four of whom have overtly right wing political views.

Sloppy journalism that fails to check the validity of its sources or doesn't care about passing on bad information if it well helps to sell the newspaper is also not uncommon. One particular case was unveiled by a more responsible newspaper, a case that reported on weather predictions, that perennial interest of the British. One newspaper trumpeted the warning "Big freeze will kill thousands". It was later discovered that this totally false prediction came originally, not from the government-financed and trustworthy Meteorological Office, but from independent forecasters. Not only was the forecast wildly wrong, but was irresponsibly passed on by the journalist. Few people have the time or the inclination to buy more than one paper to get a balanced view.

It is perhaps not surprising that a recent poll of public opinion exploring trust in the different professions, found that politicians and journalists came bottom.

4.3. Advertising

Advertisements are everywhere and increasingly intrusive. They are to be found on all sorts of available spaces, not just on billboards, but on the backs of receipts, footballers' shirts, the irritating pop-ups on one's computer and virtually any unused space that might attract attention if filled. All of these demand at least a minimum of attention, often distracting one from more important matters. There was a time when most advertising was meant to be informative, but now much of it, partly because of lack of space, is merely brand name brainwashing. The objective of advertising is to influence people in particular directions, particularly to spend their money in certain ways. It can therefore be argued that lobbying is a form of advertising where the targets are the members of Parliament, and other decision makers above the public. This sort of lobbying by business concerns has now grown to the extent that, for example, it has been reported that there are more professional lobbyists employed and equipped with offices in Brussels than there are officials of the European Union departments. This activity is, of course, legal and mostly legitimate but the general public knows little, if anything, about what passes between the two groups.

4.4. Social media

A Google search conducted by the author produced sites that contain statistics on the size of the social media network. It is estimated that there are some 152,000,000 blogs on the Internet to which 53.6 million posts are sent every month as well as 53.8 million comments. There are many specialised blog search engines as well as Google. Every second 6,000 tweets are tweeted on Twitter, amounting to 500 million a day. The Library of Congress has signed an agreement with Twitter to establish an archive of messages and is now working on the technological problem of searching the archive. Much material posted on blogs or sent as tweets will be trivial, much will be misinformation (or in the case of trolling intentional disinformation), and while much will be confined to defined communities the breadth and depth of the pool is bewildering.

As a postscript to this section mention is made of advice offered in a guide book for bloggers (Houghton, 2015). The author suggests, somewhat naively, while contradicting his own advice:

> Optimize every post with keywords. You should always include relevant keywords in your blog posts, otherwise they may not be found or read. Use "White hat techniques (ethical SEO techniques aimed at the audience and not the search engine)" only. You should also do keyword research so you can place quality keywords and phrases into your posts that will get the attention of the search engines and let them know what your post is about. Think about what someone would type into Google if they were looking for the information provided in your post and try to slip those words or phrases into your article a few times each.

5. Snapshot 3: Antidotes

There have always been organizations devoted to monitoring and challenging the pronouncements of government, commerce, the media and other strongly established institutions, but there is now a growing number of such organizations on the World Wide Web. The examples that follow in this section are all from the U.K., but almost certainly parallels are to be found in other countries. One highly professional monitor in the U.K. is the National Audit Office which is an official body, totally independent of government but reporting directly to Parliament. It scrutinizes public spending and is composed of two broad activities, one peopled by highly professional accountants examining the spending of government departments in great detail, the other concerned with 'Value for Money'. In Europe the Commission's Press Office sponsors sites in various languages devoted to the rebuttal of misinformation and disinformation spotted in the media. One example concerns a straight answer to a ridiculous claim in an anti-EU newspaper that the EU now claimed that carrots were fruit – this with no context added. The rebuttal pointed out that this could only refer to a Directive in the Directorate responsible for tarification rules that stated that for the purposes of tarification only, carrots should be classed as fruit when used in the manufacture of jams.

5.1. Some other initiatives are listed below:

- The Institute of Fiscal Studies – an independent research institute with the objective of better informing public debate on economics in order to promote the development of effective fiscal policy. The Institute was particularly active during the recent U.K. elections challenging many instances of misinformation issued by most of the parties in their campaigning (Institute for Fiscal Studies, 2016).
- openDemocracy – describes itself as a "digital commons", not a magazine, but a public service on the Web. As with the IFS it is an independent not-for-profit organization (open Democracy, 2016).
- Full Fact – another web-based independent not-for-profit service that claims to "provide tools, information and advice so that anyone can check the claims we hear from politicians and the media" (Fullfact, 2016).
- Rightsinfo – set up by a barrister and expert in human rights as a web-based service to all (RightsInfo, 2016).
- 38 Degrees – aims to "Bring you together with other people to take action on the issues that matter to you and bring about real change in the U.K." This initiative has been highly successful in collecting petitions for presentation to government and other agencies, many of which have resulted in the repeal of bad proposals. This activity is backed up by professionally conducted research and other direct actions in support of petitions, as well as hosting comments from subscribers to whom the service is free (though donations are eagerly sought) (38 Degrees, 2016).

It could be argued that the activities listed above are very similar to those traditionally undertaken by Information Scientists, though there is no evidence that such people are either managing or supporting such initiatives. If this is so, then there may be much scope for Information Scientists if they can penetrate this area of activity.

Giles presents some hope for a future antidote in an article (Giles, 2012). that reports on progress in the design of internet tools that will have the capability of uncovering misinformation. A pioneer in America is called Politifact, which employed a number of journalists to scrutinize a random collection of political statements. They found that of 400 statements issued by Barack Obama just over 1 in 4 were "mostly false", while for Mitt Romney, Obama's challenger in the presidential election the figure was over 40%. The main point of Giles' paper, however, was that work is under way to use artificial intelligence to build algorithms to support automatic discovery of misinformation on the internet.

5.2. Human problems

The advantages of the communications revolution are mostly obvious but there are problems that should, or even must be addressed. The most obvious abuses are cyberwarfare including the use of 'trolling factories' to pump propaganda into the media outlets of other countries and cybercrime, for example sending spam messages intended to trick the recipient into disclosing private information such as bank details; and trolling, the sending of abusive and hurtful messages, otherwise known as online harassment. More dangerous is the proven possibility of hacking into the controls of a car in motion switching on and off various facilities. A problem afflicting some people, most worryingly children, is online addiction to the extent that medical treatment or counselling is required. It is a common experience to find a majority of neighbours on a train glued to their laptops or iPads, or to

be bumped into on the street by people with head down to their iPad. These last two examples also illustrate the time spent in online communication and the corresponding loss of time for reflection.

5.3. No time for reflection

There was a recent report of a small study carried out at a university which involved a class of graduates attending a lecture. One half of the class took notes on their laptops, while the other half used old-fashioned pen and paper. At the end of the lecture it was found that those using pen and paper had acquired a much better grasp of the contents of the lecture; not, it must be admitted, a conclusive survey but an interesting result. Moreover, the study was conducted in a situation where the attention of the subjects was not distracted by other conflicting communications as is common, for example, in an open-plan office environment. Uninterrupted time has become a luxury, one that is presently available only, perhaps, to such as artists, musicians and scientists. Nevertheless it is surely important for anyone to be able to switch off from the constant heterogeneous bombardment of messages, leading to stress, confusion and error in normal activities, particularly in the workplace. This problem was succinctly stated by Sven Birkerts (1996) nearly twenty years ago:

> In our technological obsession we may be forgetting that circuited interconnectedness and individualism are, at a primary level, inimical notions, warring terms. Being "on line" and having the subjective experience of depth of existential coherence, are mutually exclusive situations. Electricity is, implicitly, of the moment – now. Depth, meaning and the narrative structuring of subjectivity – these are not now, they flourish only in that order of time Henri Bergson called "duration". Duration is deep time, time experienced within the awareness of time passing. . . Until quite recently most people on the planet lived mainly in terms of duration: time not artificially broken, but shaped around natural rhythmic cycles; time bound to the integrated functioning of the senses. We have destroyed that duration. We have created invisible elsewheres that are as immediate as our actual surroundings. We have fractured the flow of time, layered it into competing simultaneities. We learn to do five things at once or pay the price. Immersed in an environment of invisible signals and operations, we find it as unthinkable to walk five miles to visit a friend as it was once unthinkable to speak across that distance through a wire. My core fear is that we are, as a culture, as a species, becoming shallower; that we have turned from depth… and are adapting ourselves to the ersatz security of a vast lateral connectedness. That we are giving up on wisdom, the struggle for which has for millennia been central to the very idea of culture, and that we are pledging instead to a faith in the web.

Though this quote is hopelessly optimistic in the author's desire to turn the clock back, it does address a real problem that must be faced, one in which we must control the technology rather than letting it control us.

5.4. Loss of cognitive skills

Another author stresses the importance of not losing our cognitive skills, a view that he came to after very suddenly losing his sight and developing his mental faculties in such a way as to partially overcome his handicap. The author, Torey, is a qualified psychologist who expressed his concerns as follows (Torey, 2003):

> If I regained my sight I would want to retain the powerful skills my brain has acquired...and to convey to others how superb a resource they own and almost invariably under-use. The electronic wizardry of human inventiveness only worsens this, and I feel concerned. The brain is engaged less and less, as the computer takes care of the mental gymnastics in virtual space. The Internet does away with the touch, smell and sight ingredients of real libraries, while the ubiquitous TV refigures our visual experience with externally defined rather than internally generated images, a procedure that satisfies our fantasy-contribution and imaginative inventiveness.

5.5. Superintelligence

For some time predictions have been made concerning the arrival of the 'Singularity', the moment when machines become more intelligent than humans. Heaven (2013) has reported on the fact that there are already instances where a computer searching the Web has produced answers to questions put to it, but that the humans controlling the exercise had no idea how the computer had found the answers. Apparently the machine had found its own way in using the complex search algorithms available. Bostrom, a Professor of Philosophy at the University of Oxford and a founding member of the Programme on the Impacts of Future Technology, has written a thorough survey of the coming revolution in superintelligence (2014), outlining different scenarios together with their paths, dangers and possible strategies for dealing with the problem. The most frightening of these scenarios include research into genetic engineering to produce superintelligent humans, and the thought that superintelligent computers might be able to control robots, independently of human intervention, to overcome the computers' lack of mobility.

6. Conclusions

While completing this paper, the author attended the Biennial Conference of ISKO UK in London where, by chance, a tentative answer to one of the two questions posed at the beginning of this paper was echoed in an excellent presentation by Lambe (2015). In examining the role of Knowledge Organization professionals he distinguished between 'cataloguers' and 'designers', defining the first as describing the world as it is, and the second as planning the workings of something prior to its being made. He argued that "A design orientation is important to knowledge organization professionals, because a degree of orientation is activist, future-oriented, and geared towards desired goals." These thoughts seem to be equally applicable to Information Scientists

A second helpful idea is proposed by Bostrom (2014), one which is more hopeful than many of his other scenarios and more akin to the possible contributions of Information Scientists in which, to use his words:

> [A] conceivable path to superintelligence is through the gradual enhancement of networks and organizations that link individual human minds with one another and with various artefacts and bots. The idea here is not that this would enhance the intellectual capacity of individuals enough to make them super intelligent, but rather that some system composed of individuals thus networked and organized might attain a form of superintelligence.

The following conclusions are presented as a summary of issues discussed in the text:

1. 'Information Science' is still largely confined to the support of information practice and lacks a convincing theory, though there are many scattered studies within other disciplines that are relevant but not brought together.
2. Information practice is now a fundamental activity practised by professionals and a far larger number of people working in other disciplines. There is an opportunity for traditional information scientists to widen their role in the intelligent handling of information if they are prepared to take a more proactive stance.
3. The accelerating movement towards superintelligence is one which must be tamed and humanely utilised. Information Scientists should be prepared to take a significant role in that activity.

Where is the life we have lost in living?
Where is the wisdom we have lost in knowledge?
Where is the knowledge we have lost in information?

T.S.Eliot, The Rock, 1934

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